The South Carolina
Forest Steward
Summer 2002

In This Issue.....

The severe ongoing drought in South Carolina can present foresters and forest landowners with a variety of problems. Of immediate concern is moisture stress and its negative effects on trees. Extended drought can slow tree growth and reduce stand productivity, but more importantly can render trees susceptible to opportunistic insects and diseases. An obvious example is the current outbreak of Southern Pine Beetle. Andy Boone, Section Chief of Insects and Diseases with the South Carolina Forestry Commission has provided us with an important update on this destructive pest and an outlook for the coming growing season. In a second article he describes Annosus root rot, a conifer disease that can reduce fiber production and kill trees, particularly when they are drought stressed. Additional topics include the Hemlock Wooly Adelgid which is attacking hemlocks in Oconee County, a review of fusiform rust which is widespread across the south and "Sudden Oak Death," a new disease currently infecting trees on the west coast. You should notice that although we have few practical, direct methods of controlling insects and diseases on forested lands, awareness of the pest problem and proper stand management practices can significantly diminish losses.

Larry Nelson and Bob Franklin, Coeditors

Southern Pine Beetle Outbreak – Bleak Outlook for 2002

Andy Boone, South Carolina Forestry Commission

The 2002 southern pine beetle (SPB) pheromone trapping survey conducted by the South Carolina Forestry Commission has been completed. A total of 31 counties were trapped for SPB. Three pheromone traps were monitored in each county for a 28-day period in early spring. Results of the trappings include numbers of SPB and predators (primarily clerid beetles). Based on these numbers, an SPB population prediction trend was determined for each county. In the past, such surveys have had a success rate of over 80% in predicting the degree of SPB infestation during the following summer.

Of the counties trapped this year, Abbeville, Anderson, Cherokee, Chester, Edgefield, Fairfield, Greenwood, Kershaw, Lancaster, Laurens, Lexington, McCormick, Newberry, Oconee, Pickens, Saluda, Union and York are predicted to experience a severe southern pine beetle outbreak. In these eighteen counties the SPB catch was so high that it was off the original prediction graph (the original only went up to 70 SPB/day). In Georgetown, Greenville, Horry, Jasper and Richland Counties, sufficient beetles were caught to give a prediction of increasing-high pine mortality. One additional county, Spartanburg, is expected to have moderate beetle-caused losses. Another seven counties, all in the coastal plain, had few beetles trapped and are not expected to have major problems.

Adult southern pine beetle

Statewide, the number of SPB tripled from last year and the number of clerids caught remained nearly the same. This clerid population should not be sufficient to constrain explosive SPB development in most areas, with the exception of parts of the coastal plain. Since the SPB killed almost $76 million of pines in South Carolina last year, we can expect losses of greater magnitude during 2002. However, a hot summer with extended temperatures

Typical inner-bark galleriesof the SPB

over 100 degrees could cause a premature beetle population collapse. Additionally, the beetle population is so large that the probability of population collapse due to diseases has increased somewhat.

These trapping data results are for entire counties and there is always the possibility of sporadic and localized beetle activity in counties with overall predictions of low population levels. Activity is most likely in susceptible pine stands which are overstocked, over-mature or stagnant, have poor drainage or have littleleaf or other root diseases present and causing stress.

Beginning in June, aerial surveys will be conducted throughout areas containing beetle infestations. Landowners will be notified of beetle spots present on their properties.

With the continuing drought in South Carolina, there is a possibility of losses to other pine bark beetles that are not normally very aggressive. During the drought of 2001-2002, many localized infestations of Ips engraver beetles and black turpentine beetles occurred. These were often problems in unthinned pine stands with very high basal areas. Many of these infestations occurred in the Sandhills and other areas that generally do not experience southern pine beetle outbreaks. However, major Ips problems plagued over-mature trees on Harbison State Forest and surrounding areas. Since these insects require different control tactics than SPB, it is important to determine which insect is causing each infestation. Ips beetles can be identified by their galleries that are usually H or I shaped rather than the winding galleries of SPB. Adult Ips beetles eject the frass from their galleries while the SPB packs its galleries with frass. The black turpentine beetle attacks the basal portions of the trunk and is a much slower killer than SPB or Ips. SCFC personnel can assist with this identification or provide training where needed.

In summary, we can expect a year of fairly severe loss to southern pine beetle and related bark beetles. Control by commercial salvage is effective in stopping all of these insects. Another possibility for

Pitch tubes on SPB infested tree

control of southern pine beetle only is the cut and leave technique.

In this control strategy, infested trees and a buffer of apparently uninfested pines are cut but not salvaged. This method works best from May through October due to high daytime temperatures and SPB biological factors. It is likely that a SCFC program to pay for some cut and leave will be funded this summer. Cut and leave is not effective for Ips spots since those insects breed and mature easily in cut pines.

Please contact the South Carolina Forestry Commission or the Clemson Cooperative Extension Service if you need additional information.

Annosus Root Rot in South Carolina's Forests

Andy Boone, South Carolina Forestry Commission

Annosus root rot is a root disease of southern pines, cedars and other mostly coniferous species. It is caused by the fungus *Heterobasidion annosum*, (formerly *Fomes annosus*). Infected trees are often killed or wind thrown, and growth loss due to infection can be significant.

Initial infection by annosus in pines usually occurs through stump surfaces exposed during selective thinning. Windblown spores of annosus land on fresh stumps where they germinate and grow into the stump. The fungus then grows down the roots of the infected stump, rotting them as it grows. When the fungus reaches the junction of the diseased root and one from a healthy tree, it can spread from there into the previously healthy tree. Infection can also start in wounds on roots. Firebreak plowing, game patch maintenance, hot prescribed burning and wild hog feeding are all known to have started infections in thinned as well as unthinned stands.

Pines will fight annosus root infections by flooding infected tissue with resin. Such tissue resembles and smells like lighter wood. Sometimes this defense will stop the fungus. However, even if the fungus is stopped, any roots from the infection point outward become nonfunctional since the resin also blocks the upward flow of water and nutrients. If enough roots become nonfunctional, the tree will die or succumb to opportunistic insects (usually Ips species). In fact, annosus is often misdiagnosed as Ips infestation.

Because of its slow underground spread, annosus usually kills pines in patches. These patches of mortality often are randomly located throughout an infected stand. In the year following a thinning, these infection points are usually single pines or small groups of adjacent trees. With time, the areas of mortality can enlarge and encompass half an acre or more. A severely infected stand can have many infection centers and lose more volume each year to mortality than is being grown by the remaining healthy trees.

Some sites are more prone to annosus infection than others. Pines on deep sandy soils without high water tables are the most likely to suffer significant losses. This is because annosus is not an especially good competitor with other decay fungi that colonize pine roots. Dry, sandy soils have fewer species of fungi competing with annosus for the stump and root colonization. Additionally, infection spreads faster in sandy soils because the annosus is able to grow through the soil along root surfaces. Many coastal plain sites planted under the Conservation Reserve

Pitch-soaked wood caused by annosus root rot

Program are high hazard sites for annosus infection due to their soil type.

Site modification by extended drought or ditching may alter the infection hazard on sandy sites. Both of these impacts lower the water table and increase the probability of disease infection and spread. For example, old agricultural fields with drainage systems are more prone to disease loss than undrained sites with the identical soil types. Drought can cause temporary increases in site hazard on sandy sites, even if no artificial drainage systems are present.

Yellow stringy decay of pine root

Although annosus causes most losses from the Sandhills to the coast, it does exist statewide. In fact, annosus root infection can be found on large numbers of individual pines and cedars in the piedmont, especially in urban areas. This infection can contribute to tree mortality or catastrophic root system failure.

Early symptoms of annosus root infection include thin crowns and chlorotic (yellowish) foliage. Infected trees may have short internodes and heavy cone crops. The fruiting body of the fungus is a type of leathery mushroom called a conk. These are sometimes found under the duff around the base of infected trees. However, the lack of conks should not be interpreted as a sign of negative annosus infection since they only occur on about one percent of infected trees. When present, conks appear cream colored on their lower surfaces and light brown on the upper. Because of the way they grow in the duff, pine needles or other debris are often found imbedded in the conks.

The most reliable sign of annosus infection is found in pine roots. As mentioned above, roots that were alive when infected will have resin soaking from the point of infection toward the base of the host tree. Dead roots cannot form resin, so roots that were dead when infected will lack this symptom. However, even those roots will have the distinctive decay pattern caused by annosus. Annosus attacks the lignin of roots and leaves the cellulose component intact. Since lignin is the “glue” in wood, delignification results in a stringy decay that is characteristic of the disease.

Confirmation of annosus infection in a pine stand is done by digging roots with a sharp shovel and examining them for resin soaking and stringy rot. If both of the root symptoms or conks are found on a site, annosus should be considered present there, and its potential impacts should be considered when making future forest management decisions.

In an infected stand, it maybe useful to determine the percentage of roots that have annosus. This can be done by digging a series of one cubic foot soil pits and extracting the pine roots from each. By counting the number of healthy roots and those displaying symptomatic resin soaking or rot, an infection percentage can be determined. Although losses may not relate exactly to infection percentage, stands with high numbers of symptomatic roots should experience more losses than similar areas with low infection percentages.

The degree of mortality and growth loss to annosus is significantly increased during periods of drought stress. A pine with 40 percent of its root system infected might show minimal crown symptoms as long as plenty of water is available. However, this amount of root loss would likely be fatal during drought. Infection can result in a race by the tree to grow new roots before the fungus kills existing ones. In the absence of other stress, an otherwise healthy tree can sometimes grow enough new roots to survive infection.

Growth losses and mortality that occur due to annosus can be significant. Infection following the first thinning typically results in the largest loss of trees per acre, but later infections kill fewer but more valuable trees. A severely infected stand may

lose 15-25 percent of its trees. Growth loss is much harder to calculate, but it can result in a tangible drop in site productivity.

Once annosus infection is discovered in a stand, management options become limited. Further thinning, except for removal of infected trees, may compound infection and lead to disease intensification. However with no additional disturbance the annosus infection will collapse about seven years after it began. Severe infections may necessitate early stand termination if the management objective is solely fiber production. One positive note is that if a final harvest is done, the stand can be replanted as soon as practical since annosus rarely infects newly planted seedlings.

Annosus control is largely a matter of silvicultural manipulation. One practice to minimize the disease on high hazard sites is planting at a wide spacing in order to delay the first thinning. Root damage should also be avoided if possible. Longleaf pine is resistant to annosus (but not immune). The degree of resistance obtained may justify planting longleaf seedlings especially on a traditional longleaf site.

Infection risk from annosus is significantly reduced if thinning is done during the summer. This is because hot stump surface temperatures inhibit annosus spore germination. There are also fewer annosus conks producing spores during the summer, which translates into less potential for disease spread. However, infection is possible during the summer if cool, moist conditions occur immediately after thinning.

Stump treatment with borax is effective in reducing annosus infection in some circumstances. This treatment, which is done during thinning, seals the stump and prevents any decay from occurring through the stump surface. Unfortunately, this is ineffective if annosus is already present in a stand because the disease will continue to spread underground. Also, there is no device commercially available to apply borax during mechanical logging. Hand application of borax during such high production logging can be hazardous to the applicator. For borax treatment to be effective, all fresh stumps must be treated within 24 hours.

In summary, losses to annosus root rot will continue to increase as pines on high hazard sites are thinned. These losses can be minimized with proper silvicultural treatment and avoidance of root damage. Correct diagnosis of the disease is essential for its control. However, control options may be limited once infection has occurred. In the worst cases, landowners may have to decide whether to accept losses or clearcut the infected stand.

Hemlocks Under Attack

Howard Hiller, Clemson Extension

A new pest has been found attacking our Eastern and Carolina Hemlock trees in upper Oconee County. Known as the Hemlock Wooly Adelgid, the pest is a small aphid-like insect about the size of a period. However, it is easily recognized during most of the year by the presence of a dry white wooly substance on the young twigs. This “wool” is associated with all stages of the adelgid, but is most abundant and conspicuous during spring when egg masses are present. An egg mass resembles the tip of a cotton swab although somewhat smaller.

What is the life cycle?

Hemlock wooly adelgid completes two generations of development per year on hemlock. During March

Hemlock woody adelgid infestation.

and April, adults of the overwintering generation lay 10 to 300 eggs each in a cottony mass on the young twigs. Nymphs (called crawlers) hatch from these eggs during a period of several weeks in April and May. Within a few days, they settle on the twigs near the base of the needles where they insert their piercing and sucking mouthparts. There they feed and remain throughout their development. This spring generation matures by the middle of June.

How does it disperse?

The adelgid has been spreading relatively rapidly in North America even though its life stages are wingless and are firmly attached to hemlock twigs by mouthparts for most of the year. Eggs and crawlers, the only stages that are unattached, are abundant from March through June when they are readily dispersed by wind, birds, deer and other forest dwelling mammals, and humans during logging and recreational activities. Moving of infested nursery plants could also facilitate the spread of this pest.

Adelgid Feeding and its Consequences

Hemlock wooly adelgid prefers to feed on the youngest available twigs. Therefore, the crawlers which hatch in early spring, usually settle on the twig produced during the previous season while those which hatch in late spring usually settle on current year growth. It injures eastern and Carolina hemlock by sucking sap and probably also by injecting a toxic saliva while feeding. This causes the needles on infested branches to desiccate, turn a grayish-green color, and then drop from the tree usually within a few months. Most buds are also killed, so little new growth is produced on infested branches. Dieback of major limbs usually occurs within two years and progresses from the bottom of the tree upwards, even though the infestation may be evenly distributed throughout the tree. Trees often die within four years but some survive longer in a severely weakened condition with only a sparse amount of foliage at the very top of the crown. These weakened trees are unsightly and have little chance for recovery. They often fall victim to wood-boring insects and diseases and are readily broken and thrown by wind.

Patterns of Infestation

An infestation can start anywhere on a given tree depending upon where eggs or crawlers were deposited by wind, bird or other disposal agents. However, within a year the infestation usually has spread throughout the crown. The same pattern is true for the establishment of an infestation among hemlock trees in a forest or ornamental planting. Initially only one or a few individual trees become infested. Usually these are trees that are especially attractive to birds or are exposed to winds carrying adelgid eggs and crawlers. Therefore, it is not uncommon to have dying infested hemlocks in close proximity to healthy, uninfested trees for several years. These healthy trees are often mistakenly presumed to be resistant to the adelgid. However, in time the infestation will spread throughout the forest and all hemlocks will be affected.

Mechanically Removing Adelgids

Eggs and crawlers of hemlock wooly adelgid are readily dislodged from the young hemlock twigs by wind and rain. Most of these dislodged individuals are unable to find their way back onto the tree and die. Therefore, intentionally dislodging eggs and crawlers by directing a strong stream of water at infested branches periodically during April through June may be of some value in an integrated approach to managing hemlock adelgid populations. Clipping heavily infected twigs from branches will also reduce adelgid populations on a tree. However, extensive clipping may have undesirable effects on the appearance and health of the tree.

Planting Resistant Hemlock Species

Two Japanese and two western North American hemlock species are more resistant to hemlock wooly adelgid than are their eastern North American counterparts. Of these four resistant species, the western hemlock (*T. heterophylla*) is most similar to eastern hemlock in appearance, growth form, and utility. Although adelgids do infest these resistant species, they seldom reach densities high enough to cause injury. Therefore, planting resistant Japanese and western hemlocks should reduce the impact of the adelgid in the ornamental landscape.

Applying Pesticide Sprays

The most common and effective method for controlling hemlock woolly adelgid on ornamental hemlocks is to thoroughly drench infested trees with horticultural oil, insecticidal soap, or any one of numerous insecticides that are specifically labeled for this use including diazinon, fluvalinate, imidacloprid and malathion. Horticultural oil and insecticidal soap are used most often because they are highly effective in killing adelgids, and yet they are relatively safe to the applicator, to beneficial insects, and to the environment. Unlike the insecticides which kill insects indiscriminately by contact or ingestion, the oil and soap selectively kill soft-bodied insects, such as adelgids, by "suffocation" rather than by poisoning.

It is essential that all parts of the infested hemlock be drenched thoroughly when using an insecticide. **This is not practical in a forested situation. Thus the outlook is grim for our hemlocks in forested areas.** A backpack or garden hose sprayer may be sufficient to drench trees less than 30 feet tall, but taller trees may require the services of a professional arborist using a hydraulic sprayer. Fortunately, it is unnecessary to target a particular life stage of the adelgid for control; all are equally susceptible. Therefore, pesticide sprays can be applied at any time during the year, weather permitting. Two thorough spray treatments each year are necessary for most situations. However, one application each year may be enough, if trees are thoroughly drenched with pesticide and if there are no other infested hemlocks within 100 yards from which adelgids could readily disperse. If two applications each year are needed, an effective strategy is to spray in early April and again during late June. Another option is to spray in late September and again in early June. Either of these schedules will target both adelgid generations and minimize the impact of immigration. Because hemlock adelgid propagates and injures hemlocks so quickly, it is advisable to spray as soon as a new infestation is detected, and then to adopt one of the maintenance schedules described above.

Minimizing Losses from Fusiform Rust

Chris Demers, Forest Stewardship Coordinator, University of Florida

Fusiform rust, a disease caused by a fungus *(Cronarlium quercuum* f. sp. *Fusiforme)*, has become an epidemic in slash and loblolly pine plantations across the south since the early 1960s. Unlike most pathogens, fusiform rust attacks healthy, rapidly growing trees instead of weakened trees, creating a dilemma for managers seeking to boost the productivity of their plantations. The increase in intensively managed plantations of loblolly and slash pines, the fungus' preferred pine hosts, has created favorable conditions for extensive spread of the disease. However, knowledge gained about the fungus and its life cycle has been used to develop strategies to minimize losses from infection.

Biology and Ecology

Fusiform rust is unique in that it cannot spread from pine to pine but rather passes to an alternate host, red oaks, before infecting another pine. The fungus produces five types of spores during the course of its life cycle – two occur on pine stems and

Hazard Rating Index

Hazard	Rust in adjacent stands	Abundance of susceptible oaks within 1/2 mile of stand	Soil type	Site quality
High	>30 % of stems infected	Abundant	Moderately well-drained	>65
Moderate	10-30% stems infected	Present but not abundant	Poorly-drained	55-65
Low	<10% stems infected	Absent or very few	Very poorly-drained	<55

From Schmidt, 1981[1]

Fusiform rust canker on loblolly pine.

branches, the other three on the underside of red oak leaves. The most important red oak hosts are water, laurel, willow, and southern red oak. Cherrybark, bluejack, runner, and blackjack oaks are also important hosts on certain sites. Young oak leaves are infected in the spring by wind-borne spores produced on pines, and new pine leaders are infected later in the spring and summer by wind-borne spores from oak leaves. The fungus requires no wounds on either host to establish. Once a pine is infected, the perennial fungus causes a swelling, or gall, on the stem or branches, which often becomes infected by other fungi and insects and eventually is weakened and deteriorated.

Site characteristics that favor high fusiform rust incidence are those that are associated with abundant oaks – well-drained soils with a sandy surface and organic horizon. Conversely, poorly drained soils that do not support abundant oaks are less likely favorable for rust development.

Identification and Control

The disease can be identified by swellings on pine stems or branches, where many yellow-orange fungus spores are produced in the spring. Unfortunately, once a young stand is infected with fusiform rust, there are few options available to save the whole stand. The key to minimizing losses is prevention, which starts with an assessment of the risk of rust incidence before plantation establishment. Risk can be estimated by observing:

- the level of rust incidence in nearby young, planted stands;
- the abundance of susceptible oaks in and around the site to be planted;
- the soil type, and
- the growth potential of the site.

Fusiform rust gall.

If these cannot be estimated from field observation, try looking at a soil map. The drainage category of the soil will give you some idea of its productivity and its capacity to support oaks. Your county forester can help you interpret a soil map to determine your fusiform risk level, and he or she may know about the level of disease incidence within the county.

The most effective way to prevent rust in high and moderately high-risk areas is to plant rust-resistant seedlings, which will reduce rust incidence by two-thirds. Note that not all genetically- improved seedlings are rust resistant. Some seedlings are improved only for growth, which, if planted on a high-risk site, will compound the rust problem. Rust-resistant seedlings cost more than regular seedlings but will more than pay for themselves in the long run. It has been estimated that $20 is returned to the landowner for every dollar invested in research on disease resistance[2].

In addition to planting rust-resistant seedlings, these vegetation management techniques can reduce oak growth as well as provide early competition control:

- chemical site preparation on previously forested sites that contain oaks,
- summer controlled burns discourage oak competition;
- KG blading, followed by disking, to reduce oak regrowth.

If a stand becomes infected with fusiform rust, remove stem-infected trees and utilize them to the extent possible. Galls formed within 12 inches of the main stem can grow into the stem, thus timely pruning of limb galls from young infected trees can prevent further damage.

[1]Schmidt, R. A. 1998. Fusiform rust disease of southern pines: biology, ecology and management. Tech. Bull. 903. FL Coop. Ext. Serv., IFAS, University of Florida, Gainesville, FL.

[2]Schmidt, R.A. 2001. Fusiform rust of southern pines: preventing and minimizing financial loss. Forest Landowner 60(3):l8-21.

Sudden Oak Death

Excerpted from USDA Pest Alert NA-PR-02-20 and Bruce W. Hagen – Arborist News, December 2001.

A phenomenon known as Sudden Oak Death was first reported in 1995 in central coastal California. Since then, tens of thousands of tanoaks *(Lithocarpus densiflorus),* coast live oaks *(Quercus agrifolia),* and California black oaks *Quercus kelloggii)* have been killed by a newly identified fungus, *Phytophthora ramorum.* On these hosts, the fungus causes a bleeding canker on the stem. The pathogen also infects *Rhododendron* spp., huckleberry *(Vaccinium ovatum),* bay laurel *(Umbellularia californica),* madrone *(Arbutus menziesii),* bigleaf maple *(Acer macrophyllum*), manzanita *(Arctostaphylos manzanita),* and California buckeye *(Aesculus californica).* On these hosts the fungus causes leaf spot and twig dieback.

As of January 2002, the disease was known to occur only in California and southwestern Oregon; however, transporting infected hosts may spread the disease. **The pathogen has the potential to infect oaks and other trees and shrubs elsewhere in the United States.**

The fact that widely traded rhododendron ornamentals can be infected with the pathogen and the demonstrated susceptibility of some important eastern oaks make introduction to eastern hardwood forests a significant risk.

The Pathogen and Disease Spread

The nature of SOD spread is not fully understood; however, wind dissemination is strongly suspected. Furthermore, the movement of contaminated soil on shoes, vehicle and mountain bike tires, heavy equipment, animals, and movement of infected woody material (such as firewood, woody debris, wood chips, acorns, and leaf mold) as well as the leaves of some hosts, is likely involved in long-distance disease spread. It is unclear what role, if any, insects play in disease transmission. Spread via splashing raindrops is also suspected.

Under moist conditions, spores — either wind-borne or splashed from contaminated soil, bleeding cankers, or infected leaves of bay and perhaps other susceptible hosts — germinate and invade their host

directly through the bark. As the pathogen spreads, it kills the inner bark tissue and cambium of the lower trunk. It also invades the outer 1 to 2 centimeters (0.4 to 0. 8 inches) of sapwood, interrupting the flow of water and minerals. The roots of infected trees appear unaffected. Bleeding lesions (cankers) with large areas of discolored inner bark (phloem) occur predominantly on the lower trunk and occasionally lower branches. It should be noted that bleeding cankers have been found on tanoaks as high as 60 feet above the ground.

Ooze bleeds from a canker on an infected oak.

The pathogen appears to prefer cooler climates and is more likely to spread when weather conditions are cool and moist. It produces spores capable of swimming in moist environments. Dormant spores are produced during dry periods, ensuring long-term survival. These spores, which resist desiccation, remain viable in the soil, leaf litter, and woody material for at least several years.

Symptoms

Following inoculation, trees typically take one to two seasons to die. Leaves remain attached to limbs for up to two seasons.

Initial symptoms include oozing of a thick, dark, reddish brown to nearly black exudate through small bark fissures. This exudate typically appears as individual droplets or short (less than 1 inch long) streamers on the bark surface. Occasionally, bleeding may be more copious, resulting in patches of bark with a "sappy" appearance. Later in the year, the bark surface immediately around the dark exudate has a reddish stained appearance. Bleeding is associated with large patches [up to 1 meter (3.3 feet) across] of wet, discolored, and dead phloem and cambium. The sapwood below is stained dark. As bark tissue on the lower trunk is progressively killed, complete girdling may occur. Some oaks show moderate resistance as the cankers remain small in size. Aerial portions above the girdling wilt and die. Boring dust (frass), indicating oak bark beetle and ambrosia beetle attack, collects below and/or around pinhole-sized entry tunnels made by the beetles. Boring dust also accumulates in bark crevices and on the ground. Black, dome-shaped, fungal fruiting bodies (*Hypoxylon* fungus) up to 2 inches in diameter typically appear on the lower trunk of dying and dead trees.

Potential Impact

Sudden oak death is a potentially devastating pest problem affecting trees both in native oak woodlands and urban areas. Tens of thousands of oak and tanoak trees already have been killed by this disease. There is growing concern that the disease could spread to susceptible oaks throughout California and perhaps to other areas of the United States and Canada, as well as abroad. The economic impact for tree removal and disposal, preventative or therapeutic control measures, and loss of property values could be great. Perhaps of even greater concern is loss of environmental and wildlife benefits. Oak woodlands harbor a multitude of wildlife species, providing both food and habitat. Furthermore, they provide invaluable watershed and soil-protection benefits. Oak forests and individual trees also help improve air quality.

Immediate Concerns

Uncertainties exist regarding the biology and spread of this disease. Considerable study will be necessary in order to learn more about its life cycle, how it is spread and whether it will likely become a serious problem in eastern hardwood forests. The USDA Forest Service as well as state and private institutions are developing research programs and strategies to detect, monitor and quarantine the disease. We will try to provide information on any

significant developments future editions of this newsletter.

Do you know...

Compiled by Richard A. Harper, Extension Forester and Forest Resource Analyst, Clemson University

- South Carolina has more than twice the volume of trees today than it had 50 years ago.
- South Carolina forestland acreage has not changed significantly in the last 50 years (12.5 million acres).
- Individuals or families own 3 out of every 4 acres of timberland in South Carolina.
- More than 51% of the timberland acres in South Carolina are hardwoods or pine-hardwood.
- Less than 25% of South Carolina timberland is planted pine.
- Hurricane Hugo destroyed the equivalent of 4 years of harvesting in one night. Only 15% was salvaged.
- The Southern Pine Beetle killed almost $76 million in pines in 2001, and the value is expected to be higher in 2002. This equates to 14% of the stumpage value of all trees harvested in 1999.
- Out of $2 billion generated from agricultural delivered cash receipts in South Carolina during 1999, almost 44% ($876 million) was from timber.
- Forestry ranks third in employment and payroll of all manufacturing in South Carolina, and second in total capital expenditures.
- Economic impact from wildlife topped $1.5 billion in 1996 (wildlife recreation, hunting, and fishing).

Upcoming Events

Meetings/Courses	August 13-14	Establishing and Enhancing Wildlife Food Plants: A Shortcourse for Natural Resource Managers. Madren Conference Center, Clemson, SC.
	November 7	Lexington: Prescribed Burning. For more information, contact Beth Richardson at 803/534-6280.
	November 12	Forestry Outlook Review. For more information, contact Beth Richardson at 803/534-6280.
Landowner Association Meetings	August 5	McCormick County Forestry Association: Current Forestry Issues and Programs. 7:00 pm at Blair's Restaurant, McCormick. Supper will be served. For reservations or information, call McCormick County Extension Office, 864/465-2112.
	August 19	Abbeville County Forest Landowners Association: Forestry, Wildlife and Conservation Provisions of the New Farm Bill. 7:00 pm at Abbeville County Office Bldg., Hwy. 28 Bypass. Supper will be served. For reservations or information, call Abbeville County Extension Office at 864/459-4106.
	September 12	Lexington County Landowners Meeting: Pinestraw Productions and Marketing. For more information, contact Beth Richardson at 803/534-6280.
	September 24	Orangeburg Calhoun Forest Landowners Association (OCFLA): Land Evaluation and Private Property Rights. For more information, contact Beth Richardson at 803/534-6280.

COOPERATIVE EXTENSION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
CLEMSON UNIVERSITY
CLEMSON, SOUTH CAROLINA 29634-0110

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

- On the average a hunter will spend $1,150/year and a fisherman will spend $717/year.
- During the decade of the 1990s, South Carolina forest landowners planted 146,000 acres per year of pine trees, and ranked consistently in the top 10 states for reforestation in the nation.
- More than 99% of wood residue from manufacturing is used for other products; the major uses are fuel (49%) and fiber products (32%).
- In 1997, the 13 states that represented the Southeast delivered 59% of the raw wood used for processing in the U.S. for a value of $11.6 billion.
- There are more than 5000 products derived from trees…can you name them? Here's a few to start you thinking: imitation bacon, football helmets, pharmaceuticals, toothpaste, shoe polish, colognes, diapers, panties (rayon), hair spray, photo film, shatterproof glass, and bubble gum. So use all you want, we'll grow more!

Questions about this newsletter, submissions and requests for subscriptions should be directed to: Editor, *Forest Steward* Newsletter, Clemson University Cooperative Extension Service, Department of Forest Resources, 272 Lehotsky Hall, Box 340331, Clemson, SC 29634-0331. Phone: 864/656-2479.

The Forest Steward

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CLEMSON EXTENSION

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